ABSTRACT

This thesis presents the modelling, simulation and design of a single switch resonant inverter for induction heating Induction heating requires the generation of a high frequency alternating current This alternating current is produced by an inverter Inverters are also used in switched mode power supplies ac motor drives and uninterruptible power supplies Two popular inverter topologies are the full bridge and half bridge inverters Resonant versions of these the parallel resonant and series resonant inverters are also used These topologies have been well studied and have also been adapted for induction heating

At present large scale melting of metals using induction heating is done using a parallel resonant inverter with thyristors Operating frequency ranges from 1 10 kHz, for power levels ranging from MW to 100s of kW At medium power levels of 10s of kW the series resonant inverter is gaining ground For high frequency (>100 kHz) induction heating applications MOSFET based inverters are used At intermediate power and frequency levels other switching devices such as the power transistor or BJT IGBT SIT SiTh, MCT etc are being experimented with

The single switch resonant inverter is an extremely simple solution for low power induction heating applications such as possibly induction welding, brazing and soldering In this thesis the principle of working of the single switch resonant inverter is presented This thesis describes the mathematical modelling and computer simulation of the operation of the inverter A normalised model is developed to make the system more general The simulation results tell us how the power output, current and voltage vary with different circuit parameters, from which we can develop a design procedure Given the desired power output, operating frequency load conditions and source voltage an inverter may be designed on the basis of the simulation results

A 1 kW inverter was built to verify the design procedure Its salient points are that the source voltage is obtained from the full wave rectification of AC mains The operating frequency has been chosen around 10 kHz. The switching device is an IGBT The details of the power circuit and control circuit of this inverter are presented in the thesis